Technology in Science Upgrade
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Narrative description of how I currently use technology in the classroom in innovative ways

I obtained a grant in 1997 to begin a biotechnology program at our school. Annually since then my advanced biology students have used gel electrophoresis chambers to create DNA fingerprints and study their own DNA using our PCR machine. We make glowing colonies of bacteria after genetically transforming them with a phosphorescent protein made by a jellyfish and then use our micro-centrifuge to purify the glowing protein. All general biology classes use the equipment to make simulation DNA fingerprints. My zoology students have used our protein electrophoresis chamber to examine the proteins found in several classes of fishes.

Since obtaining a classroom laptop and video projector my daily "bell ringer" is a projected inquiry-style question for teams of students. Splitting the screen horizontally, I simultaneously project each class's assignment records, showing the current assignments and their due dates. When the laptop's screen saver turns on the students are treated to a slide show of "digiscoped" images I have taken with my digital camera and a donated spotting scope.

Students use Qwizdom, an audience response system, to respond to projected questions with a hand held remote to answer unit review questions, play review games, and enter multiple choice responses to test questions. This year students are using Qwizdom during the unit notes on imported Powerpoint files. Every few slides students respond to a question relating to the notes and the class gains instant comprehension feedback when we look at a response graph for the class. Students sometimes use Quizdom instead of Powerpoint to present their term projects.

I recently purchased Vernier Probes using part of a $20,000 grant I obtained from the Murdock Charitable Trust. So far, students have used the sensors to estimate the caloric content of foods and the CO_2 and O_2 gas production of respiring peas and photosynthesizing plants.

Beginning last spring I began writing my tests on Quizstar.4teachers.org. Students now take unit tests online, obtaining their grade upon clicking "submit." Students may review their tests online to study their mistakes.

Beginning in December I will record all of my grades on GradeConnect.com, a site similar to Blackboard.com. Feedback from parents who respond to the emails I send home make it clear that parents appreciate communication from the teacher. I predict they will feel the same way when they can verify their child's homework status and grade from their home computer.

One of my most interesting uses of our school's portable computer lab (a cart of laptops) is a website that lists the genetic sequence of the hemoglobin gene for hundreds of species. Students compare different animals to estimate the degree of relatedness based the hemoglobin gene. Students also regularly conduct web searches as part of their unit activities.

Students can see small detail from the back of the classroom when I point our video cam at a specimen. Or, I can position it over the lens of a microscope and project the microscope image to the classroom.

Narrative description of how the use of technology in the classroom has impacted students

When we use Qwizdom students typically lose time awareness. One girl famously said, "Oh no, it's time to go," when the bell rang and she was engrossed in a Qwizdom review game. Tongue in cheek, another student said, "This sucks, now" when I began using Qwizdom's pick feature which selects a student from the class to respond to a question. Because it is random, a chosen student is not off the hook after being called on once; he or she may be chosen many times. The entire class is typically interested in seeing a response graph to see how many students got a question right. If they get 100% correct, they get a prize. Without exception, simply logging in engenders interest because all students attempt to log in quickly so that they can see their name appear first on the projection screen. If a question comes up during a discussion, I can ask a spontaneous survey question to get student views on a topic. Recently in zoology, students learned from such an anonymous survey question that two of their classmates rejected evolution despite it being the course's central theme.

Vernier probes contributed to making the notoriously abstract photosynthesis and cellular respiration more concrete by creating real-time graphs of increasing or decreasing O_2 and CO_2 gas levels in a sealed container. Seeing the graph change helped students make a clear connection to the abstract chemical equations that are the engines of life on Earth. We also used gas pressure sensors to measure osmotic pressure, again producing clear, real-time graphs of our data.

Students used Vernier temperature probes to estimate calories in food. The same lab can be done more simply using a thermometer. When I asked students if they cared whether we used the Vernier probes connected to laptops

or an ordinary thermometer they unanimously agreed that using the cool Vernier probes and seeing the clear chart of changing temperature was preferable to the low-tech alternative.

Using gel electrophoresis chambers and our nifty micropipettes is always a hit. I usually explain the process the day before, which may be a waste of time because their eyes typically glaze over. But the next day when they actually "load and run a gel" students are completely engaged. When the electricity begins moving the DNA (or dyes) through the gel it calls out to students, "Explain this phenomenon!"

While students have indicated some frustration with getting accustomed to the new online testing, I recently had my first official fan of the process. A girl took the test early and I didn't have a computer version ready. Upon learning she would have to take it the old fashion way, she exclaimed, "I always do worse on paper." Apparently, she had grown fond of the computer-based tests. Students do like the color images I am able to place on the tests and the fact that I allow students to take the tests elsewhere, if proctored, is something they really appreciate.

On November 18th (the due date for this application), I will use Qwizdom to ask 32 questions regarding my use of Qwizdom, Vernier probes, and the website Quizstar.4teachers.org. I will use their input to influence my future practices with these technologies. These data are also part of the "action research" I am conducting in my class as part of a graduate level class I am taking.

Narrative description of how my proposed purchase will enable me to use technology in an innovative manner to enhance learning opportunities for my students

The Quizdom Q4 remotes communicate with the computer via a radio signal while my current Q3 model of Qwizdom remote uses an infrared signal. The Q3 model works fine in line-of-sight, but I want to extend the use of the remotes into the laboratory next door, something that is possible with a radio signal. Moreover, the Q4 model has an LCD display that allows the user to check his or her response before sending it. This is helpful when there are multiple correct answers or the answers are numerical.

Students would carry the Q4 remotes between classroom and laboratory and Qwizdom would become a regular tool for checking comprehension during labs. Students working in teams would respond to lab questions using Quizdom, gaining immediate feedback on their responses.
Should I be awarded the Qwest grant, another biology teacher has gladly agreed to take my Q3 remotes and I would instruct him in their use.

I would require a video projector for the laboratory so that students could see the results of their Qwizdom responses. To maintain an open and clutter-free laboratory, I would require a ceiling mount for the video projector. An OTC Wireless WIJET.G projector adapter would exclude the need for 50 feet of video cord running through the ceiling, down the wall, and across the floor to the computer, maintaining a safe, clutter-free environment.

The GTCO InterWrite SchoolPad 300 is similar to a Smartboard, but far more flexible. I would be able to walk from the lab to my room and use the SchoolPad 300 in each room. The device is similar to a Smartboard, except that it is small and portable. One can make annotations on any program that is running and can do so while standing near students needing a little direction.

Students may use our Vernier probes to conduct laboratories in up to 8 stations. However, having an additional demonstration station would increase student comprehension. This way, I could run a complete lab with three students per station while projecting the procedures from the front of the laboratory.

Narrative description of how what I am proposing to purchase will be used in innovative ways in the classroom

Each year I make incremental moves toward constructivism in my teaching. Now in my 11th year, and can see how far I've come. I cringe at the memory of thinking nothing of lecturing for an entire period. Just three years ago I was proud of the fact that my students faced forward in neat rows and they *listened*. Now, I'm embarrassed I ever did that. Today students sit in small groups and work on problems together *every* day. Several years ago my "bell ringer" activity was a question they individually answered about something they had allegedly learned the day before; now it's a question student teams attempt to respond to and they *can't know* the answer, nor can they "look it up." Students can only hypothesize and problem-solve and quite often they are way off the mark. Their responses are varied and messy, but the approach is more respectful of them and is more fun.

I hope to keep moving in this direction should I be awarded the Qwest grant. I want to integrate Qwizdom more fully into my daily routine. For example, 61% of 18 students I surveyed today (Nov. 17) said that I should use Qwizdom 2-3 times per week; 39% said I should use it once per week. I expect to obtain similar results tomorrow when I survey 60 more students. I would like to use Quizdom's team features to promote group problem solving. I want to continue to use Quizdom to survey student views regarding their education as a way to advance the quality of my teaching (I will conduct my first full blown survey on November 18). Should I be awarded the Qwest grant I look forward to sharing this technology with the other biology teacher who would inherit my infrared Q3 Qwizdom remotes.

Next year I will offer AP biology at our school for the first time. Should enough students enroll, I want to minimize "note-taking" and maximize inquiry. I already have most of the hardware required for the mandatory labs and I want to make these labs the centerpiece of the class. Filling out our Vernier probe collection with a demonstration set connected through a wireless connector to a laboratory video projector would enable students to clearly see the procedures and minimize time waiting for me to come to their station to trouble-shoot so they can focus on the principle we are investigating.

The idea of facing away from the students while standing in front of the room doesn't appeal to me so I never lobbied to have a Smartboard. With an Interwrite school pad, however, I could teach from any point in the classroom. Recently, I drew an illustration of protein synthesis on the dry erase board after students drew their own version from memory on paper. With an Interwrite school pad I could do this while sitting next to a student, and the whole class could see it. Better yet, I could pass the pad to the student to create a version for the entire class to see and then they could collectively critique it! Passing the school pad to a student to illustrate something (phosopholipid bilayer, osmosis, DNA) would be a fun way to learn. I imagine students would clamor to use the device and see their creation projected immediately to the whole class as they worked.

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Activity	100 Salaries	200 Benefits	300 Contractual Agreements	400 Materials and Supplies	500 Capital Objects	**TOTAL**
1, Video projector, Dukane ImagePro 8756				$1,350.00		
1, OTC Wireless WIJET.G Wireless Projector Adapter (wireless connector from video projector to computer)				$425.00		
1, Ceiling mount for video projector, 8756A Mount				$225.00		
1, GTCO InterWrite SchoolPad 300				$740.00		
26, Qwizdom Q4 Remotes				$3,700.00		
1, Vernier probe, Oxygen sensor O2-BTA				$190.00		
1, Vernier probe, Temperature probe TMP-BTA				$32.00		
1,Vernier probe, Lab Pro, LABPRO				$225.00		
1,Vernier probe, Carbon dioxide sensor, CO2-BTA				$255.00		
1,Vernier probe, conductivity probe, CON-BTA				$92.00		
1,Vernier probe, Lab Pro, Gas pressure sensor, GPS-BTA				$79.00		
1,Vernier probe, pH sensor, PH-BTA				$78.00		
9, Vernier electrode supports, ESUP				$85.00		
TOTAL				$7,476.00		$7,476.00